Development of National LCA Database Roadmaps, including further Development of the Technical Helpdesk for National LCA Databases

Deliverable D 4.3: final roadmap report for South Africa

Authors

Pippa Notten and Harro von Blottnitz
University of Cape Town (UCT), Department of Chemical Engineering
South Lane, Upper Campus, Rondebosch, Cape Town
email: pippa@tgh.co.za
email: harro.vonblottnitz@uct.ac.za

Executive summary

The availability of, and access to, life cycle assessment (LCA) data is recognised by UN Environment and the European Commission as a cornerstone of sustainable consumption and production (SCP). However, the availability of LCA data to assess the impacts from policies and product choices in specific country contexts is limited or non-existent in many countries. To address this need, the Life Cycle Initiative (hosted by UN Environment) and with funding from the European Commission, instituted a project on developing national LCA database roadmaps. The project was awarded to a consortium led by the ecoinvent Association (Switzerland), and included project partners from Brazil, Ecuador, India, South Africa, Sri Lanka, and Uganda.

In South Africa, LCA has a relatively well-established base, and academics and consultants have been generating LCA studies since the mid-1990s. LCA studies have found application in a range of industry sectors, including energy, chemicals, retail, agriculture and mining. LCAs in South African industry have primarily been through local and international consultants (often the larger multinationals), or in partnership with academia, the National Cleaner Production Centre in South Africa (NCPC-SA; with a specific focus on SMEs) and the World Wildlife Fund in South Africa (WWF-SA). Industry associations (e.g. Clay Brick Association, International Platinum Association and South African Sugar Association) have also been active in LCA in South Africa. However, there have been few coordinated activities in LCA in South Africa, which has resulted in little knowledge or data sharing between projects.

LCA has to date been less actively applied in the South African public sector, although with an increasing emphasis on evidence-based policy making and on green/circular economy, the need for credible data to support South Africa's transition to a sustainable society is increasingly being realised. Furthermore, the South African government is committed to reporting on the Sustainable Development Goals (SDGs) (which includes reporting on SCP), so the case for developing an LCA database is a timely one. However, it is essential that the LCA database resonates with the policy context in South Africa, most notably, that it is able to support the top priorities of the National Development Plan on eliminating poverty and reducing inequality.

The roadmap development process in South Africa has been led by a project team from the University of Cape Town. A National Database Working Group (NDWG) of eight members was convened, with representation across academia and research (WITS, UCT and CSIR), public sector/government (DST, DEA, NCPC-SA, The Innovation Hub and Green-Cape) and civil society (WWF-SA). Two half-day workshops and online meetings between the project team and the NDWG resulted in the generation of this roadmap report and implementation plan. The project team also received input from an International Working Group (IWG) comprised of members from the international consortium and the project convenors (the Life Cycle Initiative and the European Commission).

The roadmap lays out a vision and set of goals and objectives for the national LCA database. This is followed by specific considerations, including governance and management structures, funding and human resourcing needs. The roadmap also considers the more technical elements of database hosting and access, data needs and availability, data format and database interoperability. This is followed by an implementation plan that outlines immediate next steps,

along with medium- and longer-term activities that should to be taken to develop the national database.

The roadmap report also presents data activities that are being undertaken on the project. This activity will see South African specific datasets connected to the Global LCA Database (GLAD) network[1]. The datasets to be connected are a selection of those developed under the Sustainable Recycling Industries (SRI) project. The SRI project, coordinated by ecoinvent and funded by the Swiss State Secretariat for Economic Affairs (SECO), saw several South African universities and consultancies collaborate in the development of life cycle inventory (LCI) datasets for several core sectors of the South African economy, including electricity, liquid fuels, freight transport, cement and concrete, precious metals and agriculture. The datasets, selected to show the breadth of foundational sectors covered by the SRI datasets, will be connected to GLAD over a dedicated online platform hosted by the ecoinvent Association and available free of change.

The roadmap particularly focuses on the vision, goals and objectives of the database, as these provide a strong founding direction for the database. The vision agreed by the NDWG is:

> *The South African national life cycle database is a repository of credible datasets useful in evidence-based policy- and decision-making advancing sustainable development.*

The next step is to disseminate the roadmap to obtain further stakeholder agreement and elicit stakeholder participation in the planned activities. The most important first activity on roadmap implementation is not to lose the momentum of this project and to obtain commitments from founding partners to continue to drive the process. Another essential first step is to secure funding for an initial phase of the database, in which legal and governance structures can be put into place, and during which time the more substantial funding needed for the start-up phase of the database can be found.

 This project has provided a valuable step on the road to a South African national LCA database, providing a tangible pathway towards developing a national database and moving beyond what has up until this point been merely discussions. The roadmap can be circulated to potential partners and funders, whilst the data activities provide a concrete example of what otherwise remain as abstract concepts.

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[1] The GLAD network, is a multi-government funded initiative with UN Environment as the secretariat that aims to support LCA through providing access to data sources from around the world (www.globallcadataaccess.org).

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Introduction

Background

Life cycle assessment (LCA) has a well-established base in South Africa. Academics and consultants have been generating LCA studies in South Africa since the mid-1990s, and comprise the highest numbers of organisations and individuals active in LCA in South Africa. LCA studies have found application in a range of industry sectors, including energy, chemicals, fast moving consumer goods, retail, agriculture and mining. LCA in industry has been through self-funded projects (most often the larger multinationals) and in partnership with academia, the National Cleaner Production Centre in South Africa (NCPC-SA; with a focus on SMEs) and the World Wildlife Fund in South Africa (WWF-SA). Application of LCA in industry has also been catalysed by industry associations (e.g. Clay Brick Association, International Platinum Association and South African Sugar Association).

LCA studies to date in South Africa have generally been undertaken in a relatively ad hoc manner, i.e. according to the agendas of the particular research group or company, with little consistency between studies. Given the general lack of South African specific life cycle data, local LCA studies have primarily relied on the databases available in the major LCA software programmes (e.g. SimaPro and GaBi) and/or emission factors from public sources (e.g. Defra). An exception is the recent Sustainable Recycling Industries (SRI) project, coordinated by ecoinvent and funded by the Swiss State Secretariat for Economic Affairs (SECO), that saw several South African universities and consultancies collaborate in the development of life cycle inventory (LCI) datasets for several core sectors of the South African economy, including electricity, liquid fuels, freight transport, cement and concrete, precious metals and agriculture.

The public sector has historically been the least engaged with LCA in South Africa. However, participation of government representatives at recent LCA events in South Africa indicates an increasing engagement with LCA by the public sector. Furthermore, the increasing emphasis on circular economy and sustainable consumption and production (SCP) at the global level, along with the need for life cycle data to inform them (as indicated by the strong emphasis on life cycle approaches and national environmental data in the Ministerial Declaration of the 2019 United National Environment Assembly[2]), means life cycle data is increasingly on the agenda of the South African government as well. South Africa is also committed to reporting progress on the Sustainable Development Goals (SDGs), which includes reporting progress on Sustainable Consumption and Production (SCP).

The availability of, and access to, life cycle assessment (LCA) data is recognised by UN Environment and the European Commission as a cornerstone of SCP. However, in many countries the availability of LCA data is limited or non-existing and the assessment of impacts from policies and product choices are difficult to estimate by governments, businesses and

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[2] http://web.unep.org/environmentassembly/ministerial-declaration-resolutions-and-decisions-unea-4

individuals. This project aims to address this through the development of national LCA database roadmaps. The project is a component of the REAL[3] project, which, amongst other objectives, aims to support the development of national life cycle databases, enhance access to LCA data as well as further interoperability between LCA databases.

The National LCA Database Roadmaps project is led by the ecoinvent Association (Switzerland), and includes project partners from Brazil, Ecuador, India, South Africa, Sri Lanka, and Uganda. An International Working Group (IWG), comprised of representatives from each participating country, the European Commission, and UN Environment, informs project activities. Roadmap development is taking place through National Database Working Groups (NDWGs), composed of key actors and stakeholders of the local LCA community. The roadmap establishment process is discussed in a subsequent section of this report.

Target audience and intended use of roadmap report

The target audience of the roadmap report are stakeholders of the LCA community in South Africa, especially those with an interest in setting up a national LCA database in South Africa.

This includes:

- Government and public sectors agencies, as actors with the highest potential for funding and maintaining a national database (with an increasing mandate to do so from the global environmental agenda);
- Academia and consultants, as the largest group of users of LCA data in South Africa, and also potential generators of LCA data for the database;
- Industry, since their collaboration is needed to provide the data for national database development, as well as standing to be significant beneficiaries (through enhanced environmental decision-making capabilities, process improvements and marketing opportunities delivered through LCA studies); and
- Civil society (NGOs), to fulfil their mandate as delivering a respected neutral opinion to consumers to drive social and environmental change.

The intended use of the roadmap for developing a national LCA database is to define an agreed vision and set of goals for a South African national database, endorsed by the major LCA stakeholders in South Africa. Following on the vision and goals, the roadmap identifies concrete objectives and first steps that will need to be undertaken towards realising the National LCA database.

An important aspect of the roadmap development process is to highlight what has already been achieved in South Africa in the way of LCA data, and to demonstrate this in a tangible way to stakeholders to catalyse further actions.

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[3] The *Resource Efficiency through Application of Life cycle thinking (REAL)* project is part of the UN Environment hosted Life Cycle Initiative and funded by the European Commission

The roadmap establishment process

Baseline assessment and stakeholder mapping

The first step towards developing a national LCA database roadmap was to undertake a baseline assessment and stakeholder mapping of LCA in South Africa. The desk-based study drew on a number of number of avenues, including journal articles, current collaborative efforts[4], the participant lists of recent life cycle events held in South Africa (see Figure 1), a recent online survey on LCA training needs (undertaken by UCT and the NCPC-SA), and the authors' own networks.
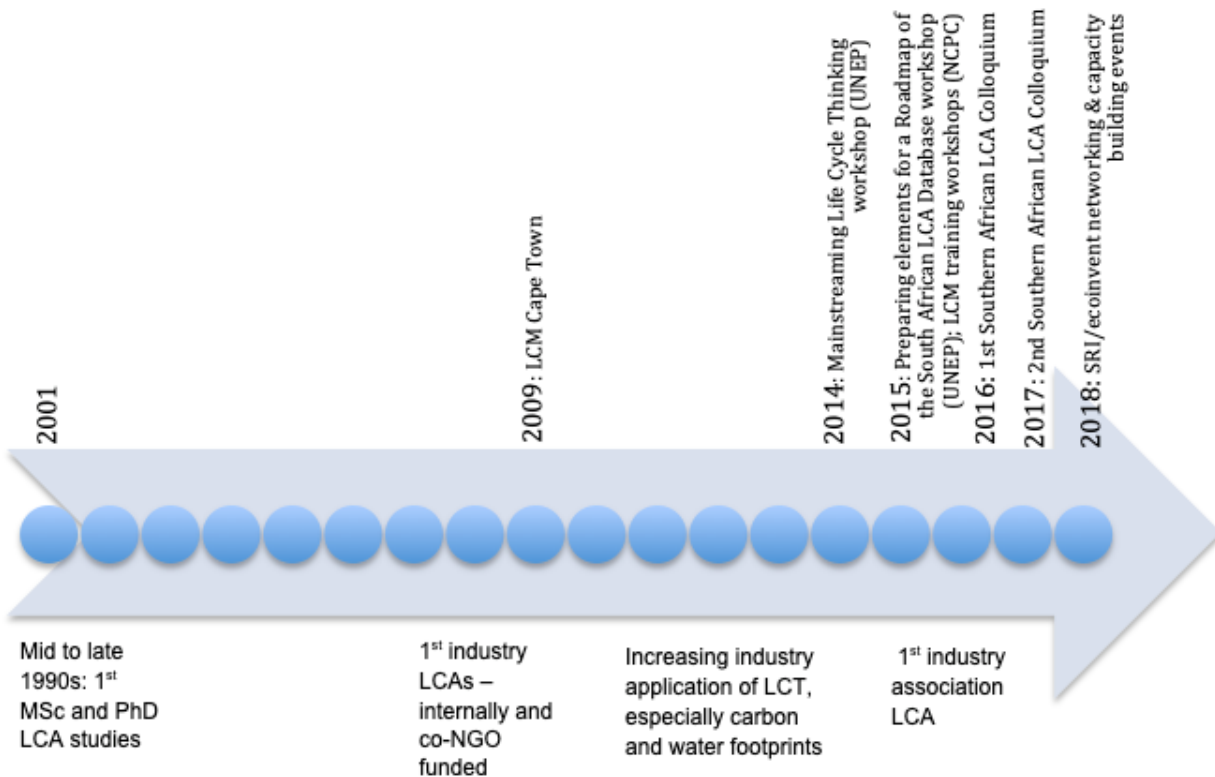

Figure 1: Timeline of LCA development and significant LC-related events held in South Africa

Just under 200 individuals were identified as being recently active and interested in LCA, with a sectoral breakdown shown in Figure 2. Together, academia, research and consulting make up the majority of individuals active in LCA in South Africa (53%). The public sector participation in LCA is likely to be overestimated in the analysis (at 34%), because the stakeholder sample included meetings with a bias towards public sector participation (with the meetings organised by the NCPC-SA). By comparison, public sector involvement in LCA was found to be only 13% in the online survey (albeit from a small sample size of 45). The online survey also indicated

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[4] Harding et al. (2019) *Status and Prospects of LCA research in South Africa* (under preparation)

LCA knowledge to be low, with only 40% of respondents indicating they had experience with LCA (with only 25% of public sector respondents indicating experience with LCA).

Full details of the baseline assessment and stakeholder mapping, including a list of recent LCA publications and research projects in South Africa, is available in the report[5].
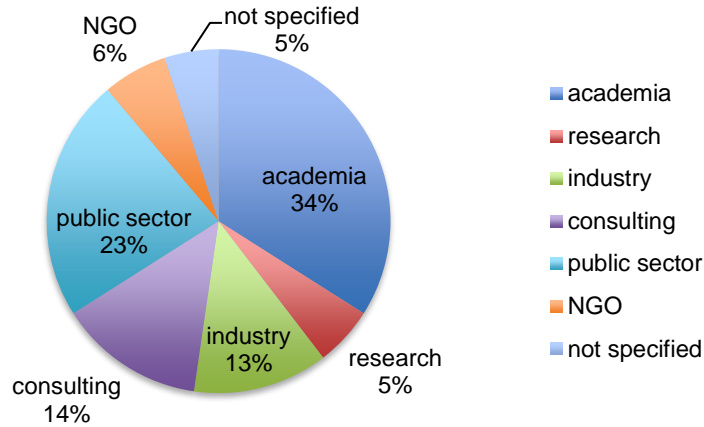

Figure 2: Breakdown in active and interested parties in South Africa.

Stakeholder consultations

Stakeholder consultation is planned throughout the roadmap process. In the initial stages of roadmap development, stakeholder consultation has been through the National Database Working Group (NDWG; see next section). Focussed consultation of a relatively small group of experts was deemed the most efficient way to develop the roadmap in the relatively short time frame available. However, wide stakeholder consultation will be sought from the South African LCA community in the first phase of the implementation plan, to ensure the roadmap developed has the support of the South African LCA community and that the roadmap process be open and participatory. To disseminate the roadmap, notices will be posted on suitable platforms and social media and emails sent to the mailing list developed during stakeholder mapping process. Individuals/organisations will be invited to register as interested parties, either to be kept in informed of the roadmap process and/or to be potential partners for future activities. Individual requests/contacts will be made if sufficient responses are not obtained from an open call for interested parties.

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[5] Baseline assessment and stakeholder mapping in South Africa, Deliverable D2.3 of the project Development of National LCA Database Roadmaps.

National Database Working Group

A National Database Working Group (NDWG) of eight members was convened, with representation across academia and research, public sector/government and civil society (see Table 1). Although currently representing the smallest group of individuals active in LCA in South Africa, government stakeholders have the highest potential for influence when it comes to hosting a national database. Public sectors representation was therefore particularly sought for the NDWG. It was also particularly planned to keep the NDWG to fewer than ten members so that the meetings could be kept focussed, and wider stakeholder input rather sought through different channels (as discussed in the preceding section).

Table 1: Members of the National Database Working Group (NDWG)

Name	Affiliation	Sector
Prof Linda Godfrey	Council for Scientific and Industrial Research (CSIR)	Research / public sector
Dr Henry Roman	Department of Science and Technology (DST)	Public sector (national government)
Mr Peter Lukey	Department of Environmental Affairs (DEA)	Public sector (national government)
Ms Lorren de Kock	WWF-SA	Civil society
Mr Lee-Hendor Ruiters	National Cleaner Production Centre (NCPC-SA)	Public sector
Dr Rethabile Melamu	The Innovation Hub	Public sector (provincial government)
Dr Kevin Harding	University of Witwatersrand	Academia
Ms Cathy Pineo	Green-Cape	Public sector (local government)

A first NDWG meeting was held in Pretoria on the 21st February 2019. Following the first meeting, a draft roadmap was prepared and feedback on the draft was obtained in two online sessions of the NDWG on the 11th April and the 25th April 2019 (two sessions were held to accommodate the availability of the NDWG members). A third NDWG meeting (half-day workshop) was held in Cape Town on the 3rd June 2019, with subsequent and on-going NDWG engagements via email.

Roadmap report writing process

The UCT project team (Dr Philippa Notten and Prof Harro von Blottnitz) led the roadmap report writing process. The NDWG provided advisory input into the roadmap writing process, in the form of consultations spanning the roadmap establishment process:

- The first NDWG meeting elicited the goals/aspirations for a national LCA database in South Africa and broadly covered the requirements of what needs to be included in the roadmap. On the back of this engagement, a draft Roadmap was prepared by the project team;
- The draft roadmap was presented to the NDWG for comment/review;
- Comments/feedback received on the draft roadmap from the NDWG as well as the IWG was integrated into an updated draft;

- The updated draft of the roadmap was presented to the NDWG at the 3rd meeting and the roadmap finalised;
- An implementation plan for the roadmap was workshopped with the NDWG, with follow-ups via email;
- The implementation plan provides the first steps to be taken for delivering on the roadmap, including the planned dissemination activities;
- Dissemination activities will include the demonstration of "core" datasets connected to GLAD[6] (in association with ecoinvent) to provide a tangible output of the roadmap process.

Dissemination activities

The roadmap report will be made available to LCA stakeholders in South Africa through suitable channels (e.g. mailing lists and social media). Dissemination is also planned through announcements at suitable local events/meetings (e.g. at the NCPC-SA's biennial conference and at LCA training events). A launch event in the form of webinar is planned, at which the roadmap will be presented, together with a discussion on implementation and next steps. Invitations to the webinar will be through targeted invites as well as open channels (social media and mailing lists). An interactive presentation of "core" datasets made accessible through GLAD is planned for the webinar, so as to provide evidence of tangible progress on a national LCA database and catalyse interest and enthusiasm to continue the process.

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[6] The Global LCA Data Access (GLAD) network aims to support LCA through easier access to data sources around the world. The network is comprised of independently-operated LCA databases (nodes) providing users with an interface to find and access life cycle inventory datasets from different providers, delivered in the user's preferred format. UN Environment serves as the Secretariat of the GLAD network (www.globallcadataaccess.org).

Roadmap for developing a national LCA database

Vision and goals

Preamble

Noting that:

the sustainable development goals (SDGs) have provided an unprecedented international cohesion for sustainable development efforts;

there is strong alignment of the SDGs with South Africa's 1st National Development Plan (NDP);

South Africa is renewing its commitments to improving quality of life for all living within its borders whilst advancing its transition to a sustainable society;

South Africa has made commitments to report on progress in reaching the SDGs;

the South African government is committed to evidence-based policy-making;

South Africa exports unique materials, goods and services to Africa and other regions of the world equally committed to sustainable development, which generates opportunities and risks for South Africa's trade and economic policies;

the science and practice of LCA have advanced to such a stage that this ISO-standardised tool can provide science-based policy- and business-relevant evidence;

and that open access to data enhances good governance and decision-making;

There is a need for a South African national LCA database.

Vision

The South African national life cycle database is a repository of credible datasets useful in evidence-based policy- and decision-making advancing sustainable development.

Goals

The following goals are identified for the South African national life cycle database so as to achieve the stated vision:

1. Open-access, transparent data for the public good, fit for use with scientifically based life cycle impact assessment methods
2. Environmental and social dimensions represented objectively for major products and services in the South African economy
3. Updated periodically as the nation's sustainability transition unfolds, to assist with quantifying progress

In the following sections, this vision and these goals are developed into 14 objectives for the national life cycle database. These are summarised in Table 2. Potential pathways to the attainment of these objectives are discussed in the following sections.

Table 2: Goals and corresponding objectives of the South African National LCA Database

		Open-access, transparent data for the public good, fit for use with scientifically based life cycle impact assessment methods	Environmental and social dimensions represented objectively for major products and services in the South African economy	Updated periodically as the nation's sustainability transition unfolds, to assist with quantifying progress
Goals				
Objectives	**Governance & management**	A governance framework that provides for scientific rigour remaining in touch with international best practice, providing policy- and business-relevance.		Regular reviews, and if necessary, adjustments to governance structure.
		Governance and management structures that ensure scientific rigour, international connectivity, and provide for accountability to funders and relevance to users.		
	Funds & financing	Business or financing model that enables open-access, appropriate to the development status (and later maturity) of the database.		Sustainable financing model that generates sufficient funds for regular updating of the database.
	Human resources	Adequate human resources secured for data formatting, expert review, IT development and support.	Adequate capacity development and resources secured for environmental and social data acquisition and reporting on SDGs.	Adequate human resources secured for periodic review and updating of the datasets.
	Hosting & access	A hosting arrangement that provides for open-access to data, interoperable with global life cycle data sources (i.e. working with existing open-source software, such as supported by GLAD)		Regular reviews, and if necessary, adjustments to hosting arrangement.
	Data needs & availability		A rigorous data collection strategy that coves the most relevant products/sectors of the South African economy and the most relevant environmental and social impacts in the South African context.	Regular review to align with global developments, especially to incorporate developments in impact assessment methods and alignment of the inventory data required to support them.
	Data quality & review	Peer reviewed datasets with data quality requirements aligned with global best practice.		
	Data format & interoperability	An internationally recognised data format interoperable with other established LCI data formats, such that the national database will be able to form a node on the Global LCA Data Access Network (GLAD)		

Organisation and finances

Governance and management

Objective 1.1: A governance framework that provides for scientific rigour remaining in touch with international best practice, providing policy and business relevance

Objective 1.2: Governance and management structures that ensure scientific rigour, international connectivity, and provide for accountability to funders and relevance to users

Objective 3.1: Regular reviews, and if necessary, adjustments to governance structure

Governance framework

An appropriate governance entity, such as a not-for-profit organisation, consistent with other international life cycle databases is suggested so as to meet the objectives of scientific rigour, policy and business relevance and accountability.

Governance and management structure

A governance structure that includes:

- A steering committee (or board), representing relevant stakeholders (including government, industry and academia) to steer the overall direction of the database;
- A separate expert committee to oversee the technical aspects of the database, such as data needs, data quality and review; and
- A database manager who would sit on both the steering committee and the expert committee. The database manager, whilst employed by the national database, would be physically hosted by one of the stakeholder institutions.

The database manager is envisaged as a salaried position, with the steering committee and expert committees volunteer positions (with expenses paid). Where necessary, the expert committee might form expert working groups, which, if funds allow, could have experts paid for their time.

Regular reviews

The governance structure should be reviewed by invited experts, for the board and disseminated to stakeholders, at least every three years.

Funds and financing

Objective 1.3: A business or financing model that enables open-access, appropriate to the development status (and later maturity) of the database

Objective 3.2: Sustainable financing model that generates sufficient funds for regular updating of the database

We foresee the development and use of the database to go through the following phases:

    i.   Design, approval and contracting;
   ii.   Start-up and growth; and
  iii.   Maturity with regular updates.

Each phase will need an appropriate financial model.

For the design, approval and contracting phase, expected to take 12 months, project finance is needed; key stakeholders should seek those funds from a national government department with a funded mandate for such capacity development and/or an international development partner. Budget should include sufficient expert consultant time as well as legal fees to enable the key stakeholders to contract.

In the start-up and growth phase, proposed to last 3 years, financing is needed for:

- Preparing existing datasets into the database format;
- Development work to align with reporting on the SDGs and including social aspects;
- Making datasets accessible to first users;
- Receiving feedback and database technical and maintenance work; and
- Development of additional datasets.

In the mature stage, there may be potential to raise some income from value-add services to local and international clients. However, with an open-access goal, the database stakeholders will need to budget for continued support to enable regular updating and continuous response to users of the database.

Human resources

Objective 1.4:   Adequate human resources secured for data formatting, expert review, IT development and support

Objective 2.1:   Adequate capacity development and resources secured for environmental and social data acquisition and reporting on SDGs

Objective 3.3:   Adequate human resources secured for periodic review and updating of the datasets

This is the most costly aspect of the national database. Recognising that expertise on how to create and operate a national life cycle database has already been developed in a number of countries it is proposed to work with experts specialised in this know-how. This has the twin objectives of keeping costs low and building national capacity.

Depending on the funds able to be raised and the funding model, this is envisaged either to be in the form of a seconded expert or by inviting firms specialising in database development to bid to provide the identified services. The database manager will work closely with the international expert. Additional local capacity needed for the national database will be identified as the project progresses. Capacity-building and local empowerment will be built into the contract conditions, so as to build up local know-how on these specialised services over time and to enable a move to gradual independence.

Data and database

Database hosting and access

Objective 1.5:   A hosting arrangement that provides for open-access to data, interoperable with global life cycle data sources (i.e. working with existing open-source software, such as that supported by GLAD)

Objective 3.4:   Regular reviews, and if necessary, adjustments to hosting arrangement

The database hosting platform would hold current, archived and in-development versions of the database; the current version to be distributed on demand to users registering with the database management system. The database manager will curate the datasets and administer access to the database.

The database will be subject to regular reviews and updates (at least every three years) in line with the reviews of the management and governance structure.

Data needs and availability

Objective 2.2:   A rigorous data collection strategy that covers the most relevant products/sectors of the South African economy and the most relevant environmental and social impacts in the South African context

Objective 3.5:   Regular review to align with global developments, especially to incorporate developments in impact assessment methods and alignment of the inventory data required to support them

The data collection strategy would be fully developed during the design phase; a short-cut approach to specifying the most relevant sectors and products would be informed by experience from other similar countries whereas a more rigorous approach (ideally) would be informed by national material and substance flow analyses.

Relevant environmental and social impacts are to be determined from the SDGs, and a review of published studies read in conjunction with stated policy outcomes.

Reviews of impact categories that can be computed from the inventory data included in the database are to take place at least every three years. These should specifically aim to keep abreast of the science of regionalised indicators, such as those pertaining to water stress and biodiversity impacts.

Data quality requirements and review

Objective 1.6:   Peer reviewed datasets with data quality requirements aligned with global best practice

The data quality specifications, along with the protocols for ensuring these are adhered to, would be developed in the database design phase. Given that these have been developed in other contexts for other national databases, the option of adopting a working system for use in

the South African context should be favourably considered. In doing so, unique national challenges need to be kept in mind, e.g. in relation to representativeness, the prevalent inequality may make it challenging to work with one national average for some indicators.

Data format and database interoperability

Objective 1.7: An internationally recognised data format interoperable with other established LCI data formats, such that the national database will be able to form a node on the Global LCA Data Access (GLAD) network.

The choice of data format from within those already developed and compatible with GLAD will be made early on in the design phase of the national database. The choice is likely to be influenced by the selection of international database expert to partner with for the development of the database (as discussed under the 'human resources' heading). This in turn may possibly be influenced by funding partner.

Interoperability over the Global LCA Data Access (GLAD) network

The dual recognition that South Africa sits within a global economy and that combining with existing global LCA databases will significantly expand the reach of the national database (especially when starting out), means that being interoperable with other LCI databases is a stated objective of the national database. A founding intention is thus for the South African national database to be able to form a node on the GLAD network.

Promotion of LCA uptake in policymaking

The National Development Plan 2030 (NDP) provides a broad strategic framework for South Africa. The top stated aims of the NDP are to eliminate poverty and reduce inequality, and these remain the cornerstone of government policy. For life cycle data to be relevant to the South African policymaking context, it thus has to be coupled with some sort of socio-economic indicators. The ability to provide this social dimension is a core goal of the South African national database, and whilst some of this can be adopted from the emerging tools of social LCA and life cycle sustainability analysis (LCSA), there will inevitably need to be a fair amount of development done on the more uniquely South African elements (notably inequality) to make life cycle data relevant to the South African policymaking context.

Nonetheless, the NDP explicitly considers climate change and includes interventions to ensure environmental sustainability amongst its critical actions. Chapter 5 of the NDP: Environmental Sustainability and Resilience particularly talks to the need for indicators to inform policy, and thus indicates a clear need for life cycle tools and approaches to support policymaking. Furthermore, whilst Chapter 5 explicitly mentions the need for quantitative data (for setting targets and reporting on progress) on waste, carbon and natural resources, life cycle data also has application in other Chapters of the NDP. This includes Economy and Employment (innovation and green economy) and Economic Infrastructure (covering water, energy and

transport), where the insights and tradeoffs that LCA brings will be invaluable, and ties in with government's stated aim of evidence-based policy making.

The overall vision up to 2030 is provided by the NDP, and policies, strategies and legislation developed need to reflect this vision. The Industrial Policy Action Plan (IPAP) developed by the Department of Trade and Industry translates the vision of the NDP into a five-year action plan. Green Industries is a sectoral focus area of the current IPAP (covering the period 2018/19 to 2020/21). In addition, the need for a move towards green economy is mentioned in a number of the other focus areas, including national export effort, aerospace & defence, mineral beneficiation, infrastructure and plastics. All of which point to there being a strong basis for life cycle data to support the development aims and competitiveness of South African industry.

The South African government is committed to implementing and reporting on the UN's Sustainable Development Goals (SDGs). An analysis undertaken by the Department of Environmental Affairs found strong alignment between the SDGs targets and the NDP's objectives, with 74% of the SDG targets addressed by the NDP (and of the SDG targets not addressed in the NDP, 19% addressed in other government sectoral programmes). The need for reliable sustainability-related data on South Africa's industry and infrastructure to support reporting on SDGs is thus timely, as is the need for credible life cycle data to support policy decisions embedded in the principles of the SDGs and NDP.

Data-related activities

A selection of datasets from those developed in the LCI component of the SRI program have been chosen in collaboration with the ecoinvent Association for demonstration in GLAD. The datasets, chosen to show the breadth of foundational sectors covered by the SRI datasets, are listed in Table 3. The datasets will be connected to GLAD as unallocated unit processes and made available free of charge over a dedicated online platform hosted by the ecoinvent Association in the second half of 2019. The GLAD API/web-service established internally by ecoinvent will be used for uploading/connecting the JSON-files to GLAD.

In addition to profiling the South African data that has been developed under the SRI project, the data related activities are valuable in that they provide a concrete example to the otherwise somewhat abstract concept of data interoperability and GLAD.

Table 3: List of South African datasets to be connected to GLAD

Activity name	Reference product
beef cattle production on pasture	cattle, live weight
diesel production, petroleum refinery operation	diesel
electricity production, hard coal, conventional	electricity production, hard coal
electricity production, hard coal, supercritical	electricity production, hard coal
gold mine operation and gold production, unrefined	gold, unrefined
gold refinery operation	gold, refined
hard coal mine operation, open cast, dragline	hard coal, run-of-mine
hard coal mine operation, open cast, truck and shovel	hard coal, run-of-mine
hard coal mine operation, underground	hard coal, run-of-mine
hard coal preparation, coal washing	hard coal
hard coal preparation, crushing and destoning	hard coal
maize grain production	maize grain
maize grain production, rainfed	maize grain
market for cattle for slaughtering, live weight	cattle, live weight
market for diesel	diesel
market for hard coal	hard coal
market for maize grain	maize grain
market for transport, freight train	transport, freight train
platinum group metal, extraction and refinery operations	platinum group metal
synthetic fuel production, from coal, high temperature Fisher-Tropsch operations	synthetic fuel
transport, freight train, diesel	transport, freight train
transport, freight train, electricity	transport, freight train
transport, freight, lorry 16-32 metric ton, EURO1	transport, freight, lorry 16-32 metric ton
transport, freight, lorry 16-32 metric ton, EURO2	transport, freight, lorry 16-32 metric ton
transport, freight, lorry 16-32 metric ton, unregulated	transport, freight, lorry 16-32 metric ton

Roadmap implementation plan

Roles, responsibilities, activities and timeline for roadmap implementation

An implementation plan for the roadmap, providing activities and the roles of the entities responsible for carrying them out, is outlined below. However, as the roadmap is at its earliest stages of implementation, this plan will require redevelopment and updating as the roadmap process progresses. Specifically, at the beginning of the "Start-up and growth" phase, once the level of funding is known and management is in place, a detailed work plan for the database will need to be drawn up. This will most likely be drawn up by the database manager, with inputs from the Technical Committee, and approved by the Steering Committee.

Table 4 provides a first set of activities to be undertaken to implement the roadmap for a South African national database, with longer term activities given in Table 5. The activities are broken down into three sets corresponding with the phase of database development:

- **Short-term activities**: These are activities that need to be done as soon as possible (i.e. within the next 6 months), and are the immediate things that need to be done to keep the roadmap process going;

- **Medium-term activities**: These are activities that need to be undertaken during the "Design, approval and contracting" phase of the database. These activities, to be undertaken over a 12-month period once the initial contracting has been concluded (i.e. over the next 6 to 12 months), will see the governance and management structures of the database set up and funding secured for the next phase;

- **Longer-term activities**: The activities listed here are the first data-related activities of the "Start-up and growth phase" of the database. They are therefore anticipated to be undertaken in roughly 12 months' time, and assume funding has been secured and management and hosting structures have been set up during the preceding phase. A much more detailed plan for the "Start-up and growth" phase of the database will be drawn up during the "Design, approval and contracting" phase, specifically once the level of funding and the type of international partnerships forged are known.

Table 4: Immediate activities to be undertaken for roadmap implementation

	Activity	Responsible	Description
Short term activities	Establish founding partners	UCT project team	Potential founding partners for a national database were brainstormed at the 3rd meeting of the NDWG. This was followed up with emails to potential partners to start the dialogue. These efforts will continue for the remaining weeks of the project, so that the roadmap process does not end with the current project but has specific individuals within relevant stakeholder organisations that have expressed commitment to continue the process.
	Disseminate the roadmap	UCT project team	A webinar is planned to launch the roadmap. Invitations will be sent to potential participants using the networks of the project team and NDWG members, as well as posted on relevant social media. The webinar will be used to obtain stakeholder feedback on the roadmap as well as invite future participation. The datasets connected to GLAD will be demonstrated at the webinar.
	Establish "champion" for the roadmap process	Founding partners	At the first meeting of the founding partners, it is suggested that a "champion" be appointed from one of the organisations with a mandate to drive the roadmap process forward. i.e. to drive the subsequent short-term implementation steps in consultation with the founding partners.
	Secure funding for the "Design, approval and contracting" phase of the database	Database "champion" and founding partners	Initial funding is required to maintain momentum on the national database project. This needs to be for at least 12 months, and will fund the initial stages of the database whilst governance, management and fund-raising structures are put into place. An important first activity is thus to identify potential sources of funding (e.g. by exploring synergies with existing projects and funding vehicles of the founding partners) so as to secure the initial funds to cover the contracting and, if possible, a consultant to drive the process.
	Appoint a consultant to drive the "Design, approval and contracting" phase of the database	Database "champion" and founding partners	Assuming funding can be secured, a Request for Proposals (RfP) should be drafted by the founding partners with the scope of work for the first phase of the database, i.e. covering the initial design of the database, approval of the design with stakeholders and setting up the legal framework of the database (including contracting between the founding partners).
	Decide on an appropriate legal framework for the database	Founding partners (led by consultant, if appointed)	Professional legal advice should be sought on the most appropriate vehicle to be adopted for the database entity (e.g., non-profit company (NPC), type of government agency etc.). The decision should also draw on international examples, as well as what has worked in South Africa for similar entities. Once decided, the database entity should be set up accordingly (e.g., NPC registered with CIPC).

Table 5: Activities to be undertaken for roadmap implementation in the medium (6 to 12 months) and longer terms (12 to 36 months)

	Activity	Responsible	Description
Medium term activities	Develop a detailed cost estimate for the 2nd phase of the database (Start-up and growth)	Consultant (once appointed) and founding partners	In important activity, needed before potential funders can be approached, will be to develop a detailed cost plan for the first 3 years of the database (Start-up and growth phase). This will need to consider the technical and infrastructure needs of the database, as well as human resources and data projects going forwards.
	Explore funding options and partners for the Start-up and growth phase of the national LCA database	Consultant (once appointed) and founding partners	A critical component of the first phase of the database will be to secure funding for the next phase. If possible, funding will be leveraged off partnerships that can also bring expertise into the project.
	Develop a detailed proposal for the database governance and management structures, and the database hosting arrangement	Consultant (once appointed) and founding partners	The plan for the database governance structure outlined in the roadmap will be refined, e.g. a small number of founding partners (steering committee) complemented by a technical committee and stakeholder user group. It is expected one of the founding partners would be the hosting partner for the national LCA database. The plan to include international partners with proven experience in database governance and management will also be further developed.
	Appointment of Database Manager, Steering Committee and Expert Committee	Founding partners, assisted by consultant	Going into the "Start-up and growth phase" the management and governance positions will need to be filled. The Steering Committee will likely include the founding partners, but additional members might be sought. The Expert Committee will be needed to progress the first data-related activities and so also needs members to be appointed, as does the position of Database Manager (see "Governance and management" section for a description of these roles).
Longer term activities	Develop an appropriate format for the National Database, especially considering the need to include socio-economic aspects and support reporting on SDGs	Expert committee (overseen by Database Manager)	This activity will review global best practice on database formats, and particularly look into formats where socio-economic data are included with LCI data. Projects where LCI data are being used to support reporting on the SDGs will also be reviewed, along with the data needs of SDG reporting. A suitable data format compatible with GLAD will be chosen, and a plan put forward as to how this can be developed to include a meaningful level of socio-economic reporting.
	Identify available datasets and priority data projects to be implemented	Database manager and Expert Committee	This activity is to determine a workplan on data activities for the database. The activity will review what datasets are available and of suitable quality so that they can relatively easily be incorporated into the database. Following this, an analysis of priority data needs in South Africa will be undertaken, with a priority list of potential data projects for the national database developed as an output.
	Plan (and execute) data projects	Database manager, Steering committee	Based on the priority data needs for the database (output of previous task), this activity will develop a plan for data projects to be undertaken, e.g. through putting them out to tender (if funds are available), providing funding for Masters projects etc.
	Develop a funding plan and identify potential funding partners for the mature phase of the database	Database Manager, Steering Committee	A long-term funding plan for the database will need to be developed, respecting the commitment to be open-access but finding sufficient revenue streams for regular updating and providing continuous response to the users of the database. In addition to costing the continued running of the database and predicting revenue streams (e.g. from providing services to users or charging non-South African users), the activity will identify potential funders and initiate dialogue with them (as this is needed well before the initially funded phase is over to ensure continuity in the database).

Stakeholder commitments

Commitments to be founding partners of the National Database are currently being sought from relevant entities. Relevant parties approached are:

- Department of Science and Innovation within the Ministry of Higher Education, Science and Innovation
- Council for Scientific and Industrial Research (CSIR)
- National Cleaner Production Centre South Africa (NCPC)

WWF-SA have stated their commitment to be the civil society founding partner of the national LCA database.

Budget and resource constraints

Budget is a significant constraint to the implementation of the database roadmap. Currently no funded mandate exists for a national database. Amongst the first activities of the implementation plan is thus to seek funding from an appropriate government department or international development partner. Initial activities of the founding partners are thus required to be self-funded.

The funding requirements of the database is broken into three phases:

i. Design, approval and contracting: A first phase with relatively modest funding requirements to cover consultant time and expenses (e.g. legal fees). Funding for this phase is anticipated to be around $20,000 (assuming the contracting phase can be concluded within 12 months);

ii. Start-up and growth: Detailed costing of this phase is an initial activity of the implementation plan. It is expected to be fairly substantial as it needs to cover a minimum of three years and cover important foundational activities of the database, e.g. development work on the database format (incorporating socio-economic aspects), preparing first datasets (adapting/updating existing and commissioning projects) and technical and maintenance work;

iii. Mature phase: Developing a self-sustaining funding model for the mature phase is a medium-term activity in the implementation phase. Whilst potential sources of income will be explored (e.g. from providing services to local and international database users), with open access being an important foundational principle of the database, some sort of legacy funding will likely need to be found.

Along with funds, technical skills in developing and managing an LCA database are also a potential constraint. A plan to overcome such constraints is to work with international partners that have experience in LCA database development, ensuring such partnerships involve a capacity building element that allow the necessary skills to be transferred and the South African national database to become independent in time.

Risk management

The most significant risk in roadmap implementation is that the founding partners are not able to find sufficient resources to drive the process forward. As it stands, there is no specific entity with funds and a mandate to drive the roadmap forward, thus there is a risk that the momentum built up in this project will be lost due to no one driving the process when the current project ends. To this end, the remaining time on this project will be spent trying to mitigate this risk by obtaining the commitment of founding partners and appointing a "champion" from within one of these organisations to drive the process (to take on the first steps of the implementation plan up until a database manager can be appointed).

A further significant risk is that a funding partner and/or international donor is not found for the database. Relatively modest funding is required for the first phase of the database (Design, approval and contracting), with more substantial funding anticipated for the second phase (Start-up and growth). It is planned to leverage international funding off the back of domestic funding (i.e., to access joint domestic and international funding through a relevant government programme), especially for the more substantial funding required for the 2nd phase. A considerable risk is thus that the desired level of funding is not able to be obtained. Mitigation of this risk is to start with relatively modest funding requirements in the first phase of the database, and to use this time to build partnerships and look for more substantial funding opportunities.

International donor funding is identified as a potential means to accessing both funds and the skills needed for database development (e.g., through a seconded expert). Thus, there is a risk to both funds and skills/capacity if an international partnership is not secured. Mitigation of this risk is to develop sufficient local skills on the back of domestic funding, but this is likely to take longer and be more expensive in the long run than partnering with an expert on LCA database development. However, a notable risk associated with the international expert-partnership model is that skills are not transferred and the database becomes an externally managed entity. This risk requires careful management, especially when setting up agreements and/or contracts at the start, taking care that these explicitly address skills transfer. It is also very important that sufficient national resources are devoted to the project, especially in terms of funding for local personnel to work alongside the international expert. National funding - potentially augmented by funds raised from the database - and skilled personnel are also essential to ensuring the sustainability of the project (i.e. to ensure that the database will continue into its mature phase once international funding/partnerships reach the end of their term).

Conclusions and recommendations

The intention of this roadmap report is to provide a tangible pathway towards developing a South African national LCA database. The roadmap particularly focuses on the vision, goals and objectives of the database, as these provide the founding direction for the database. These have been established in consultation with a National LCA Database Working Group (NDWG) formed for the purposes of roadmap establishment. The next step of the roadmap process is to disseminate the roadmap and elicit stakeholder participation in the planned activities.

This project has provided a valuable step on the road to a South African national LCA database, moving it beyond what has up until this point been merely discussions. The roadmap provides a tangible output that can be circulated to potential partners and funders, whilst the data activities provide a concrete example of what otherwise remain as abstract concepts. The most important first activity on roadmap implementation is not to lose the momentum of this project and to obtain commitments from founding partners to continue to drive the process. Another essential step to keep the database roadmap process going forwards is to secure funding for an initial phase of the database, in which legal and governance structures can be put into place, and during which time the more substantial funding needed for the start-up phase of the database can be found.